

REMARKS

Status of the claims:

With the above amendments claims 1, 7, and 8 have been amended. Claims 1-13 are pending and ready for further action on the merits. No new matter has been added by way of the above amendments. Support for the amendments to claims 1, 7, and 8 can be found at page 8, lines 11-12, page 9, lines 7 to 9, page 10, lines 4-5 and page 17, lines 2-5. Reconsideration is respectfully requested in light of the following remarks.

Double Patenting

Claims 1-13 are rejected by the Examiner under the judicially created doctrine of obviousness-type double patenting over claims 1-9 of Okada '007 (U.S. Patent 6,525,007 B2) for the reasons set forth on page 2 of the Office Action.

This rejection is traversed for the following reasons.

By copolymerization of (i) ethylene, (ii) an α -olefin of 3 or more carbon atoms, and (iii) a higher α -olefin of 4 to 20 carbon atoms wherein the carbon number of (iii) is larger than that of (ii) by one or more, it is possible to obtain a lubricating oil composition excellent in low-temperature properties, oxidation stability, lubricity at high temperatures and fuel efficiency.

Okada '007 does not describe the copolymerization of (iii) together with (i) and (ii).

It is described in Okada '007 that the recurring units derived from at least one monomer selected from α -olefins of 4 to 20 carbon atoms, cycloolefins, polyenes and aromatic olefins may be contained.

However, the specific combination of monomers and the specific ratio thereof as claimed in the present invention is never disclosed or suggested in Okada '007.

Accordingly, the present invention cannot be rendered obvious under the doctrine of judicially created obviousness-type double patenting by the disclosure of Okada '007. The rejection is inapposite. Withdrawal of the rejection is warranted and respectfully requested.

Rejections under 35 U.S.C. §103

Claims 1-13 are rejected under 35 U.S.C. §103 as being unpatentable over Engel '429 (U.S. Patent 3,697,429).

Claims 1-13 are rejected under 35 U.S.C. §103 as being unpatentable over Gillis '019 (WO 97/38019).

These rejections are traversed for the following reasons.

Present Invention

The present invention as recited in claim 1 relates to a viscosity modifier for lubricating oil comprising an ethylene/α-olefin copolymer (B) composed of:

(i) ethylene,
(ii) an α-olefin of 3 or more carbon atoms, and
(iii) a higher α-olefin of 4 to 20 carbon atoms wherein the carbon number of (iii) is larger than that of (ii) by one or more, and

the ethylene/α-olefin copolymer (B) has the following properties (b-1) and (b-2):

(b-1) a content of ethylene (i) is in the range of 60 to 80 % by weight, a content of the α-olefin of 3 or more carbon atoms (ii) is in the range of 15 to 39 % by weight, and a content of the higher α-olefin of 4 to 20 carbon atoms (iii) is in the range of 0.1 to 20 % by weight with the proviso that the sum is 100 % by weight; and

(b-2) a weight-average molecular weight (Mw) in terms of polystyrene as measured by GPC is between 80,000 and 400,000; and

(b-3) the ethylene/α-olefin copolymer (B) has an intensity ratio D of $S\alpha\beta$ to $S\alpha\alpha$ ($S\alpha\beta/S\alpha\alpha$) determined by a $^{13}\text{C-NMR}$ spectrum of 0.5 or below.

Disclosure of Engel '429

Engel '429 discloses a lubricating oil composition comprising a lubricating oil and a viscosity index improving amount of an oil-soluble polymer composition comprising a first copolymer of ethylene and a C₃ to C₁₈ higher α-olefin having an ethylene content of 50-95 mole percent (40-83 wt. percent) and a second copolymer of ethylene and a C₃ to C₁₈ higher α-olefin having an ethylene content 5-80 mole percent (3-70 wt. percent), the ethylene content of the first copolymer being at least 5 mole percent (4 wt. percent) more than the ethylene content of the second polymer.

Disclosure of Gillis '019

Gillis '019 discloses a liquid phase polymerization process for producing a polyolefin elastomer, e.g., one derived from ethylene, another α-olefin such as propylene and optionally, a diene, employing a metallocene catalyst. The process comprises contacting a monomer under liquid phase polymerization conditions with a catalyst composition obtained by combining (a) a metallocene procatalyst, preferably one containing a bridging group possessing at least two bulky groups, and (b) a cocatalyst such as aluminoxane, preferably a cation-generating cocatalyst, in partial or total replacement of aluminoxane.

Removal of the Rejection over Engel '429

Engel '429 discloses that a halide of a transition metal, preferably titanium and vanadium, is used as a polymerization catalyst. Vanadium chloride is the only species used in the examples in Engel '429.

However, the copolymer of (i) ethylene, (ii) an α -olefin of 3 or more carbon atoms, and (iii) a higher α -olefin of 4 to 20 carbon atoms wherein the carbon number of (iii) is larger than that of (ii) by one or more is never copolymerized in Engel '429. That is, a higher α -olefin is never copolymerized in the examples in Engel '429 at the molecular weights that are claimed in the instant claims because Engel '429 was unable to introduce the higher α -olefin at the molecular weights with the catalyst Engel '429 used.

However, to more clearly distinguish the instant invention over the disclosure of Engel '429, Applicants have amended the independent claims to recite a specific $S\alpha\beta/S\alpha\alpha$ ratio, which can be attained by the catalyst of the instant invention but cannot be attained by the vanadium catalyst used in Engel '429.

Moreover, by making a lubricating oil comprising the ethylene/ α -olefin copolymer (B) with a $S\alpha\beta/S\alpha\alpha$ ratio being 0.5 or below, the instant inventors were able to achieve

improvements in flowability at low temperatures and in lubrication properties at high temperatures. This balance (i.e., balance between the low temperature flowability and the high temperature lubrication properties) is especially good in the instant invention.

These effects are neither disclosed nor suggested by Engel '429. Thus, Engel '429 cannot render obvious the instant invention. Withdrawal of the rejection is warranted and respectfully requested.

Removal of the Rejection over Gillis '019

Gillis '019 discloses a polyolefin elastomer and lubricating oil composition containing the elastomer as a viscosity modifier. The elastomers comprise ethylene- α -olefin copolymers containing from about 35 to about 80 weight % ethylene, the balance being olefins such as propylene and optionally diene monomer(s), which can be present in amounts of about 1 to 20 weight %.

However, Gillis '019 never discloses that the content of ethylene (i) is in the range of 60 to 80 % by weight, the content of the α -olefin of 3 or more carbon atoms (ii) is in the range of 15 to 39 % by weight, and the content of the higher

α -olefin of 4 to 20 carbon atoms (iii) is in the range of 0.1 to 20 % by weight with the proviso that the sum is 100 % by weight.

The ethylene/ α -olefin copolymer (B) for use in the invention comprising (i) ethylene, (ii) an α -olefin of 3 or more carbon atoms, and (iii) a higher α -olefin of 4 to 20 carbon atoms respectively in the above-noted amounts, promises a lubricating oil composition with sufficient low-temperature properties as well as excellent handling properties at low temperatures.

Applicants herein attach a 37 CFR §1.132 declaration, executed by Keiji Okada, one of the inventors of the instant invention, that show the superior effects of the instant invention. These effects are reproduced in the below Table 1.

Table 1.

	Ref. Ex	C-Ex.1	Ex.1	Ex.2	Ex.3	Ex.4
Used Polymer Type		P-Ex.1	P-Ex.2	P-Ex.3	P-Ex.4	P-Ex.5
Amount (wt%)						
Lubricating Oil Base	88.98	89.04	89.04	89.04	89.04	89.04
Detergent-Dispersant	10.0	10.0	10.0	10.0	10.0	10.0
Pour-Point Depressant	0.5	0.5	0.5	0.5	0.5	0.5
Copolymer	0.52	0.46	0.46	0.46	0.46	0.46
Lubricating Oil Properties						
K.V. at 100°C (mm ² /s)	10.08	10.16	10.14	10.13	10.11	10.11
SSI	52	48.0	47.0	47.0	46.0	46.0
CCS	3140	2780	2770	2790	2760	2750
MRV	49800	23200	23100	23200	22900	22800
Low Temperature Flowability	1	2	1	1	1	1

Examples 1 to 4 and Comparative Example 1 are described in the present specification. The Referential Example is a result experimentalized by the present inventor in order to emphasize the present invention's superiority and to point out the differences with Gillis '019.

In the Referential Example, ethylene-propylene-octene-ENB copolymer was polymerized in accordance with Example 30 of Gillis '019. The obtained copolymer had an ethylene content that was 56 % by weight, a propylene content that was 30 % by

weight, an octane content that was 8 % by weight, and an ENB content that was 6 % by weight. The Mooney viscosity (ML₁₊₄) of the copolymer was 39 and the weight-average molecular weight (M_w) in terms of polystyrene was 2.71 X 10⁵.

The lubricating oil was produced from a mixed oil that was 88.98 % by weight, which was composed of Mineral Oil 100 Neutral and Mineral Oil 150 Neutral (by ESSO) (Mineral Oil 100 Neutral/Mineral Oil 150 Neutral = 80/20) as a lubricating oil base, the obtainable polymer was 0.52% by weight as a viscosity index improver (viscosity modifier), Aclube 133 (by Sanyo Kasei) was 0.5 % by weight as a pour-point depressant, and a cleaning dispersant (by The Lubrizol Corporation) of 10 parts by weight. The properties and the flowability at a low temperature of the lubricating oil obtained were evaluated in the same way as the Examples of the present invention.

The obtained lubricating oil containing the copolymer of the Referential Example had higher SSI, CCS, and MRV than that of the Examples of the present invention (please see the above table). That is, the specific content of (i) to (iii), especially the specific content of (i), of copolymer contained in lubricating oil accomplished better low-temperature properties. In other words, the copolymer that falls outside of the scope of the present invention provides unacceptable low-temperature properties of the lubricating oil.

Thus, not only does Gillis '019 fail to disclose the elements of the instantly claimed invention, the instant invention also has unexpectedly superior properties over the disclosure of Gillis '019.

In other words, the excellent effects of the present invention can only be accomplished when the features as claimed in the instant invention are met. Because Gillis '019 does not disclose nor suggest the specific content in copolymer in the present invention, and because the instant invention discloses unexpectedly superior properties over Gillis '019, Gillis '019 cannot render obvious the present invention. Withdrawal of the rejection is warranted and respectfully requested.

With the above remarks and amendments, it is believed that the claims, as they now stand, define patentable subject matter such that passage of the instant invention to allowance is warranted. A Notice to that effect is earnestly solicited.

If any questions remain regarding the above matters, please contact Applicant's representative, T. Benjamin Schroeder (Reg. No. 50,990), in the Washington metropolitan area at the phone number listed below.

Pursuant to the provisions of 37 C.F.R. §§ 1.17 and 1.136(a), Applicants respectfully petitions for a one (1) month extension of time for filing a response in connection with the

present application. The required fee of \$110.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: Declaration under 37 CFR 1.132 by Keiji Okada